The RUBBER RESEARCH INSTITUTE of CEYLON

Vol. 35 Part 4.

4TH QUARTERLY JOURNAL

DECEMBER 1959

10 JUN 1960

RUBBER RESEARCH INSTITUTE OF CEYLON

4th Quarterly Journal

VOL. 35, PART 4 DECEMBER, 1959.

CONTENTS

PAGE

The Discolouration of Bleached Crepe Rubber— ... ...
by K. F. Heinisch 80

Minor Pests of Rubber Plantations 86
(Contribution from Plant Pathology Department)

Planting Topics 93

Question Corner 96

Book Review 99

Minutes of the 164th and 165th Meetings of The Rubber Research Board ... 100

NOTICES

DARTONFIELD GROUP—VISITORS' DAY

Those who wish to visit the Institute are requested to do so after making an appointment. No special days are set apart as Visitors' Days and the services of the technical officers can be availed of for discussion or demonstration only by prior appointment.

PUBLICATIONS

Rubber Research Institute publications comprising Annual Reports, Quarterly Journals and occasional Bulletins and Advisory Circulars are available without charge to the Proprietors (resident in Ceylon), Superintendents and Local Agents of rubber estates in Ceylon over 30 acres in extent. Advisory Circulars and Smallholdings Leaflets in English or Sinhalese will be available without charge to smallholders on application. Forms of application can be supplied on request.

It will be appreciated if subscribers will return any back publications which are of no use to them.

ADVISORY CIRCULARS

The undernoted Advisory Circulars may be obtained on application at 30 cents per copy. Future issues in the series will be sent free of charge to estate and small holders registered for the receipt of our publications:—

(5) Straining box for latex (January, 1940).

(12) Warm Air Drying House for Crepe Rubber (Reprinted 1952).

(33) Mechanical Felling of Rubber Trees (Reprinted March, 1955).

(37A) Manuring—Magnesium Deficiencies in Rubber (July, 1954).

(37B) Potassium Deficiencies (September, 1954).

(38) Planting and After-Care of Budded Stumps and Stumped Budgrafts (Superseding Advisory Circular No. 8) (March, 1953).

(39) Clonal Seed as Planting Material (Superseding Advisory Circulars (No. 26 and 27) (July, 1953).

(40) Tapping of Hevea Rubber (Superseding Advisory Circulars No. 17 and 34) (June, 1954).

(41) Pink Disease (June, 1954).

(44) Diplodia Dieback and Collar Rot of Hevea and Blue Spot of Crepe Rubber (June, 1954).

(47) Ustulina Rot Rubber Trees (November, 1954).

(49) Root Disease in Replanted Areas (Superseding Advisory Circular No. 31) (October, 1951).

(50) Orange Gall of Hevea (December, 1954).

(51) Bird's Eye Leaf Spot of Hevea (December, 1954).

(52) A Guide to the Cost of Replanting Rubber (December, 1954).

(56) Cover Crops (Superseding Advisory Circular No. 25) (October, 1955).

(57) Notes on Rubber Seedling Nurseries (Superseding Advisory Circular No. 35) (October, 1955).

(58) Notes on Budgrafting Procedure (Superseding Advisory Circular No. 1) (December, 1955).

(60) Sale of Budwood (Superseding Advisory Circular No. 42) (June, 1958).

(61) Prevention of Coagulation in the Field (Superseding Advisory Circular No. 53) (September, 1958).

(62) The White Root Disease of Hevea—Fomes (Lignosus (Superseding Advisory Circular No. 46) (October, 1958).

(63) Brown Root Disease of Hevea—Fomes Noxius (Superseding Advisory Circular No. 48) (December, 1958).

(64) Bark Rot and Canker of Hevea—Phytophthora Palmivora (Superseding Advisory Circular No. 54) (December, 1958).

(65) The Phytophthora Leaf Disease of Hevea—Phytophthora Palmivora (Superseding Advisory Circular No. 45) (December, 1958).

(66) Manuring of Rubber (Superseding Advisory Circulars No. 59 & 59A) (April, 1959).

THE DISCOLOURATION OF BLEACHED CREPE RUBBER

By

K. F. Heinisch

Introduction:

Many enquiries have been received at this Institute concerning the discolouration of crepe rubber prepared by bleaching with RPA. 3, and the steps that should be taken to prevent this discolouration. Although the method of application of this bleaching agent and the factors causing the discolouration during manufacture and storage have been discussed in several publications (1, 2, 3) a short up to date review of the principal factors involved is given in this article.

It is known that a number of factors may singly or collectively influence the changes in the appearance of the bleached crepe. Some estates appear to obtain better results from the bleaching procedure than others and there are estates which are unable to convert their latex into a white crepe by the use of RPA. 3 without a considerable removal of yellow fraction, and, even then, discolouration may occur after a long period of storage or after shipping.

It is not possible to define precisely which factors exert the greatest effect under certain conditions and no definite rules can therefore be laid down for the prevention of discolouration. The same applies to the proportion of RPA. 3 required for bleaching and to the method of preparation.

Bleaching:

For the manufacture of bleached crepe three different methods have been used, *viz.* (1) bleaching without fractional coagulation, as is the case with white latices (2) fractional coagulation with bleaching of the "white" fraction only and (3) fractional coagulation after adding the bleaching agent to the latex.

Taking into account the different conditions obtaining on estates, the choice of the best method and the amount of bleaching agent to use have to be decided by each estate concerned. In case of difficulties with discolouration or in the use of the bleaching procedure, it is important to conduct small-scale trials in order to assess the relative importance of all factors of influence and on the basis of the results obtained to initiate large-scale manufacture.

The amount of RPA 3 required for bleaching is very small and depends on the inherent properties of the latex and on the method of bleaching, but it is generally 0.025% to 0.1% for normal RPA 3 and 0.01% to 0.04% for concentrated RPA 3, calculated on dry rubber. Since RPA 3 has a tendency to soften rubber and to increase tackiness when used in too large amounts, the upper limits shown above must be considered the maximum dosage, which under no circumstances should be exceeded. In most cases the amount required for a good bleaching effect will be much lower than that of this upper limit.

Since RPA 3, which is xylyl mercaptan dissolved in a kerosene type solvent, is not soluble in water, it must be emulsified prior to use with a suitable emulsifying agent, such as the commonly used Duponol OS. In order to correct some very common misconceptions it should be stated that Duponol OS is neither a bleaching agent nor is it involved in any way in the bleaching procedure, but that it acts only as an emulsifier to make the bleaching chemical, *viz.* RPA 3, miscible with water.

For the preparation of a standard 5% emulsion, 10 parts by weight of RPA 3 and 0.5 to 0.7 parts of Duponol OS are first well mixed and then stirred with 190 parts of water. Because of a tendency of separation it is advisable not to keep a stock of the emulsion but to prepare it afresh whenever required. The concentration of the emulsion should not be higher than 5%, especially in cases where larger quantities of latex have to be bleached, because it will make it more difficult to obtain a homogeneous mixture with the latex. There is, however, no objection to the preparation of a stock mixture of RPA 3 with Duponol OS. In this connexion it must be borne in mind that RPA 3 is susceptible to oxidation and that the containers should always be kept tightly closed. Under these conditions the material is stable for long periods.

Discolourations:

The most common defects of pale crepe treated with RPA 3 are a reddish or greyish discolouration or dull colour, either immediately after preparation or after a prolonged period of storage or transport, or an unsatisfactory, non-homogeneous bleaching effect or bad colour-holding properties with an unstable bleach. In most cases it is not the RPA 3 or the type of latex that is responsible for the discolouration or poor initial colour, but conditions which are not properly controlled during manufacture, as well as carelessness and lack of cleanliness. There are only very few clones, *e.g.* PB 186, War. 4, Tjir 1, with a yellow latex, which may cause difficulties or be unsuitable for bleaching.

Precoagulation and Anticoagulants:

For effective bleaching it is important that the latex arrives at the factory in a good condition and not in a state of incipient coagulation, *e.g.* thickened or containing some precoagulum. Under the latter conditions the bleaching agents cannot be homogeneously distributed to all yellow coloured particles, with the result that a part of these remains unbleached and yellow streaks will appear on the crepe after machining.

It is necessary therefore to use an anticoagulant in the field in all cases where the slightest precoagulation or thickening can be expected. Sodium sulphite or formalin or soda ash or a mixture of formalin and soda ash are recommended for use as anticoagulants. Under certain conditions it seems that the use of sodium sulphite may slightly improve the colour, especially when manufacture is carried out without fractional coagulation. For the application of formalin it should be mentioned that the commercial product has in most cases an acid reaction due to a small content of formic acid. It must, therefore be neutralized with a solution of soda ash before use. In order to reduce the rate of multiplication of bacteria which may be an indirect cause of discolouration by liberation of sulphur, the anticoagulants have to be added to the latex as early as possible, whether in the cups (shells) or in the collecting buckets before collection (4).

As ammonia has been found to produce a darker coloured crepe and to be responsible for greyish discolourations, its use as anticoagulant is undesirable.

Experience has, moreover, confirmed that during wet weather water-extractable materials from the bark, which are washed down in the cups may strongly increase the tendency for unexpected brownish discolourations. Care has to be taken to see that the cups are dry and clean and free from scraps. Wet and dirty cups promote a rapid growth of bacteria which can result in precoagulation and discolouration.

Sodium bisulphite:

The RPA 3 is able to bleach the carotinoids present in the yellow fraction of the latex, but it does not prevent any discolourations caused by enzymatic oxidation of the non-rubber constituents. It is therefore necessary to use in addition sodium bisulphite at a concentration of 0.5% to 1.0% on dry rubber, mixed into the latex as a 2 to 5% solution to prevent such discolourations, at least in cases where formic acid is applied as the coagulant. It has been also observed that by using oxalic acid in combination with RPA 3 under certain conditions, the omission of sodium bisulphite might produce a better colour of the crepe prepared either from fractioned or unfractioned latex, than when this chemical is used. Under certain conditions, however, the addition of sodium bisulphite has a definite advantage in producing a white crepe.

Taking into account the different conditions and the present limited experience it has not yet been possible to define clearly the conditions when the addition of sodium bisulphite could be safely omitted. It appears that the composition of the latex, its stability and the prevailing weather conditions are of major influence. Preliminary small-scale trials will give an indication whether a better colour without sodium bisulphite could be obtained. Attention should also be paid to the colour holding properties.

In applying sodium bisulphite it must be kept in mind, that an excess of it is objectionable because it retards the rate of drying and thereby increases the risk of development of mould on the dry crepe thus causing spots and blemishes of different colours ranging from yellow to black (5).

It is important that the sodium bisulphite is of good quality. The use of poor quality sodium bisulphite may cause brownish discolourations to appear on both bleached and unbleached crepe. Normal quality sodium bisulphite contains about 61.5% of sulphur dioxide as active constituent. On exposure the chemical decomposes quite rapidly resulting in a decrease of the sulphur dioxide content and consequent in a drop in activity. Moreover the sodium bisulphite is hygroscopic and part of the free sulphur dioxide dissolves in the moisture it absorbs from the air forming sulphurous acid ($H_2 SO_3$) which attacks the iron containers and dissolves the iron. Such poor sodium bisulphite is not only of doubtful activity but contaminates the latex with an excess of iron and causes strong discolourations.

When handling sodium bisulphite it is always advisable to inspect the containers and to reject those that are badly damaged. Fresh sodium bisulphite occurs in a powder form and if found as hard lumps is in a state of deterioration.

The containers have to be kept tightly closed and should not be left open unnecessarily. Stock solutions of 10% or 20% can be prepared, provided they are kept in air-tight bottles. If in doubt a sample of the bisulphite should be sent to the Rubber Research Institute in a well sealed container (tin or flask) for analysis.

As already mentioned, the RPA 3 has a tendency to soften the rubber even when used in small amounts. This softening within tolerable limits is due to the

bleaching procedure; sodium bisulphite on the other hand has a certain hardening effect, which compensates for this softening.

Water:

The quality of water used for standardization, dilution of chemicals and milling may strongly affect the colour of the final product. Especially the presence of iron in the water may be the cause of brownish or greyish discolouration in bleached crepe. From practical experience it seems that it is hardly possible to manufacture a reasonable white or spotless crepe if the iron content of the water is higher than approximately 1 mg/litre. The effect of discolouration may be increased further if a high iron content is linked with too high a permanganate value, *viz.* if the water has a high content of oxidizable organic matter. This implies a strong infection by micro-organisms and the creation of a favourable environment for development of fungal growth. In a recent paper (6) attention has been drawn to the importance of the quality of factory water, which is often overlooked. Generally speaking contamination of the latex with iron seems to play an important role in the discolouration of crepe, most probably due to the reaction of iron with the sulfhydryl group of the RPA 3 by forming some iron sulphur compounds.

It has been observed that in case of a shortage of water during the dry season some estates either do not dilute the latex sufficiently or do not dilute it at all for the preparation of crepe. When using the bleaching procedure this practice should not be resorted to, as much more serum constituents will remain in the rubber than during normal manufacture, causing reddish discolourations which tend to develop very slowly taking perhaps days or even weeks after preparation. The latex has therefore to be diluted to a D.R.C. of at least 18% (29 oz./gal.), or even less, before addition of the bleaching agent.

Coagulation:

The appearance of crepe seems to depend on the time of storage of the latex, and too long a storage may cause some discolourations. Coagulation should therefore be carried out shortly after arrival of the latex at the factory. By overnight coagulation, which is practised mostly in Ceylon, care should be taken to see that the amount of acid is sufficient to form a coagulum after $1\frac{1}{2}$ to 2 hours. Shortly after the formation of the coagulum, it should be covered with water to a height of 1 inch. If too little acid is used for coagulation, a discolouration of the crepe may appear. A sign of a shortage of acid is a milky serum, containing some 0.5 to 1.5% of rubber. A well performed coagulation should give a clear or slightly opaque, yellowish coloured serum. It should be mentioned that the amount of acid required for coagulation is not constant but depends on different local factors, such as the amount and kind of anticoagulant, weather, pH of the water, etc. If a milky serum is found after coagulation, the amount of acid has to be gradually increased.

The coagulation rate with acetic acid is rather slow and, under certain conditions, gives sufficient time for the latex to ferment even after the addition of the acid. The use of formic acid should therefore be preferred and it also has an antiseptic value. The quantity of formic acid required for coagulation is about 5 to 6 ounces of strong acid per 100 lb. of dry rubber and it has to be increased if soda ash is used as anticoagulant. The acid should be added in the form of a 1% solution, *i.e.* 1 part of acid mixed with 89 parts of water (concentration of the strong formic acid is normally 90%).

It has been found that an improvement in colour and colour-holding properties can be obtained, if oxalic acid is used in place of formic or acetic

acid. Oxalic acid has a suppressing effect on iron and on calcium, which may act as inhibitors of enzymatic action, and reduces the chance of discolouration due to oxidation. The favourable features of oxalic acid are still more pronounced after a longer period of storage of the bleached rubber. There are also indications that, at least in certain cases with white latex, removal of a first yellow fraction might be unnecessary when oxalic acid is used. Fractional coagulation has always the disadvantage of being time consuming and in producing only a part of the crop into a first quality product, a considerable proportion of the balance being of a lower grade. For estates having white latex it may be suggested to carry out small-scale trials with oxalic acid without removal of the first yellow fraction and if the results are good to adopt its use on a large scale. It should be emphasized that the best results can only be obtained if oxalic acid is used after the addition of the appropriate quantity of RPA 3 bleaching agent. Oxalic acid alone is not a bleaching agent.

The amount of oxalic acid required for coagulation is about 8 to 12 ozs. per 100 lb. dry rubber, added as a 2% solution. As the crystalline oxalic acid is not very soluble in cold water it should be dissolved first in 10 parts of warm water and then diluted with cold water to a concentration of 2%. Oxalic acid should not be dissolved in metallic containers but in glass jars or in glazed earthenware such as Shanghai jars. It should be handled carefully as it is a poisonous substance. Although it is not more dangerous than formic acid (oxalic acid is a natural constituent of different fruits and vegetables, such as pineapples, rhubarb, spinach, etc.), there is no natural warning against its misuse, because of the absence of a strong caustic smell like that of formic acid or of acetic acid and it appears to be quite harmless due to its crystalline nature. The maximum daily dosage is about 1 to 1½ grams. A few cases of poisoning have been reported from estates in Sumatra, where labourers used formic and oxalic acid for domestic purposes, *viz.* cooking and preparation of salads.

Milling and Drying:

During milling of crepe a large quantity of water has to be used to avoid heating of the rubber due to friction, especially on the smooth mill. Inadequately cooled mills affect the appearance of the crepe and generally produce a dull colour. Furthermore a dry milling as is necessary for blanketing results in a considerable production of heat and causes the crepe rubber to darken. In general lace crepe has a whiter appearance than blanket crepe and this white appearance is largely lost during the operation of blanketing. Furthermore blanketing is a high power consuming procedure. In this connexion it may be mentioned that crepe rubber from the two largest rubber producing countries, namely, Malaya and Indonesia, is practically always marketed and shipped in lace form.

It has been found that light is to a large extent essential for a proper bleaching but, on the other hand, too much light produces a brownish discolouration. In practice about 6 to 12 hours exposure to diffuse light appears to be sufficient. In most cases the amount of light absorbed during manufacture and handling in the drying shed is more or less adequate. The interior of the drying shed itself should be nearly dark.

Under no circumstances should the drying temperature exceed 95°F (35°C), as above this temperature rapid darkening occurs. Where heated drying sheds are used a careful control of the temperature is essential.

Summary:

The discolouration of bleached crepe is influenced by a number of factors during all stages of manufacture and therefore properly controlled conditions and cleanliness are essential for the manufacture of a first quality product.

The condition of the latex and the manufacturing and drying conditions are as important as the quality of the chemicals and the factory water. It would appear that small amounts of iron have quite an important role, probably due to the formation of some iron sulphur compounds. An improvement in colour and colour-holding properties can be obtained by using oxalic acid as coagulant implying, at least in certain cases with white latex, that a removal of a first yellow fraction might be unnecessary, thus increasing the outturn of first quality crepe.

References:

1. Risdon, E. J. *Rubb. Res. Inst. Ceylon Quart. Circ.*, 1952, 28, Parts 3-4, 3.

2. Anon. *R.R.I.M. Plant. Bull.*, 1954, No. 10, 7.

3. Jacobs, H. *Bergcultures*, 1955, 24, 161.

4. Anon. *Rubb. Res. Inst. Ceylon Adv. Circ.*, 1958, No. 61.

5. Heinisch, K. F. & Kühr, P. *Arch. Rubb. Cultiv.*, 1957, 34, 1.

6. Heinisch, K. F. *Rubb. Res. Inst. Ceylon Quart. J.*, 1959, 35, 32.

MINOR PESTS OF RUBBER PLANTATIONS

(**Contribution from Plant Pathology Department**)

From time to time enquiries are received at this Institute on methods of prevention and control of various animal or insect pests that cause damage to rubber plants. Some of these do little damage, but others are more regular pests which may cause more serious damage in nurseries and young plantings if not kept under control.

Any one of these minor pests may, under certain conditions, develop into a major pest.

The recommendations contained in this note have been selected from various sources as control measures which practical experience has shown to give the best results under average conditions. They should be taken as a general guide only and may be altered to suit particular conditions.

A.—ANIMAL PESTS.

Elephants, cattle, deer, pigs, hare, squirrels and bats may cause damage, especially in plantations close to jungle areas.

Elephants:

Elephants break off branches, uproot small trees, destroy fences and often open a way for other animals.

Control: If damage by elephants becomes serious an elephant belt may be provided on the jungle boundary, as the best way to keep off these animals. An elephant belt is formed by felling a belt of jungle, about 25 to 50 yards wide, and leaving the felled timber all tangled up. Two strands of barbed wire may be run through this maze of timber.

Fencing is used by estates which have no jungle boundaries.

Deer:

Deer strip the bark of the trees and may completely ring bark the stems.

Control: Provision of strong barbed wire fences around the plantations.

Pigs:

Pigs strip the bark and damage the roots.

Control: Barbed wire fence, with a trench close by, is a good method of keeping off these animals.

Cattle:

Cattle eat the foliage of young rubber plants and may cause considerable damage in nurseries and young plantings.

Control: Construction of cattle gates at the road entrances of the estate and erection of strong barbed wire fence around the replanted areas and the nurseries.

Monkeys:

Monkeys wantonly break off twigs and tear leaves, they also eat the green fruit, bud shoots and young leaves and may cause considerable damage in young nurseries.

Monkeys are a menace only on estates adjoining jungle.

Control: Occasional shooting of a few monkeys and hanging up the corpses in a conspicuous place are reported to be an excellent deterrent to others of the troupe.

Hare:

The tender foliage of young rubber plants, especially in nurseries, is eaten by these animals.

Control: Provision of a wire netting enclosure around the nursery.

Porcupines:

Porcupines are one of the most common and serious pests of young rubber plants. They gnaw the bark of the stem, often well up to two feet, and may sever the stem of young plants.

In severe cases, especially in 3 to 5-year-old plants, the base of the stem may be completely ring-barked.

Control: The damage by porcupines can be minimized by either trapping or by repelling these animals.

An effective repellant that does not damage young plants is a mixture based on nicotine extract (as *e.g.* "Black Leaf 40", "Nicotox-Sandoz 20").

This mixture is made up by mixing about two tablespoons of nicotine extract in a gallon of thick rice water to which sufficient lime is added to make it into a consistency suitable for application to the stems of the plants. The mixture is painted on the stems up to a height of 18–20 inches from ground level in areas which are liable to porcupine damage.

Bandicoots, Rats and Squirrels:

Bandicoots burrow underground and gnaw away at the collar of young plants sometimes severing the tap root. Usually the first indication of Bandicoot attack, is the falling over of the plants.

Rats and Squirrels may cause severe damage in nurseries and in young plantings. In seedling nurseries the seed kernels and the young shoots are eaten. The symptoms of rodent damage in young plants are gnawing of the bark at the base of the plant, the damage sometimes extending to a height of 3 feet. In more severe cases the stems are often totally girdled, the foliage damaged, the terminal buds nipped off and the bark stripped off.

Control: These rodents can be successfully controlled by laying down in the infected areas Dicumarin-based rodenticides. These Dicumarin-based poisons (as *e.g.* listed in alphabetical order Racumin 57, Tomorin, Warfarin) should be preferred to the older types of rat poison as they are more effective and are safer to handle.

The poison bait may be prepared in the following way: One part of the Dicumarin bait concentrate (containing 1% Dicumarin) is well mixed with 40 parts of dry foodstuffs, such as broken cereals, crushed dried fish. 4 to 6 ozs. of the bait mixture is laid out in as many places as possible in the vermin-infested areas. The bait is placed with advantage on a piece of wood, cardboard or on short lengths of bamboo.

The bait should be checked regularly and missing bait balls should be replaced. To ensure death, it is necessary that each animal consumes small quantities of the bait for 4 to 5 days. The treatment may be considered as ended when the bait balls are no longer eaten, which usually happens between the 5th and the 14th day. Generally 7 to 8 days of regular baiting is sufficient.

It takes a considerable time before a new rat population builds up again in the same area. To prevent the recurrence of rat damage baiting may be carried out from time to time at a few strategic points.

To ensure success of the treatment, it is important to use only good quality dry foodstuff. This must be crushed well to enable the animal to eat the bait on the spot. Further, the Dicumarin-based bait concentrate and foodstuffs must be well mixed by shaking or rolling in a closed container.

Bats and Flying Foxes:

These nocturnal flying mammals chew the leaves and spit out the residue. The trees mostly affected are of clone Glenshiel 1 but young Tjirandji 1 clonal seedlings have also been attacked. Damage resulting from these attacks may on occasions reach serious proportions.

Control: Trapping by slinging large-mesh nets among the trees at night has been successful under Ceylon conditions.

Snails and Slugs:

Snails have a conspicuous shell while slugs have either no shell or only a small shell hidden in a fold of the skin. The most common snail found in rubber plantations is the Giant or Kalutara Snail (*Achatina fulica*). This snail originates from Africa and has been known in Ceylon since about 1900. The snail has a chestnut brown shell marked with light brown lines.

One of the common slugs is *Mariaella dissumieri*. This slug is of yellowish brown colour and is mottled on the dorsal side with darker dots and streaks. It is about 2 to 3 inches long. Snails and slugs can do severe damage to young rubber plants and to cover crops. They feed at night and hide by day in the shade of the undergrowth. They are seen in abundance during wet weather.

Snails and slugs devour the tender foliage of the young plants. They eat the terminal bud of rubber plants and when side shoots develop these suffer the same fate, resulting in a distorted stem. The growth of the plant is thus considerably retarded.

On mature rubber trees, snails and slugs may occasionally eat the inner bark tissue exposed by tapping.

Control: Satisfactory control can be obtained by the use of bait containing metaldehyde.

Powdered metaldehyde ("Meta") is mixed well with bran, chaff or coconut poonac at the rate of ½ ounce to one pound. To this mixture water is added to make a stiff mash which can be moulded into small lumps or balls. Approximately 60 bait balls can be made from one pound of the mixture.

The bait balls are distributed in the clearings about 20 feet apart and at the rate of 3 to 5 pounds per acre. Closer spacing of the baits is necessary during the rainy season. Old dried bait balls can be collected, crushed, moistened, remoulded and used again. It is better to protect the bait balls from sun, rain and birds with country roof tiles or short lengths of split bamboo or any other form of protection which allows the snails and slugs to reach the bait balls.

In order to prolong the durability of the bait, especially during wet weather, the R.R.I. of Malaya has developed a new formula for making metabran bricks, which, although not as attractive to the pests as fresh baits, remain effective for weeks if not months.

The formula contains in parts by weight:—Meta 1, Lime 6, Cement 6, Rice Bran 2 and the method of preparation is described as follows:—"The finely powdered meta, lime and cement are mixed dry with the bran, then about one-third of its volume of water is added with much kneading to get the mixture evenly wetted until it has the consistency of building mortar, when it is cast into small bricks in a suitable mould. To become really firm they must be allowed to dry slowly for about a week before being distributed over the infested area".

In addition to the above, a mixture of the following composition is considered to be very effective for the control of these pests:—

12 bricks of meta (approximately 1.7 oz.)
4 lb. whiting
½ lb. tapioca flour
1 gallon water

"The tapioca flour is made into a paste with two-thirds of the water; with the remaining third, a mixture of finely powdered meta and whiting is made into a cream, then the two suspensions are thoroughly stirred together".

This mixture can be applied by brush to the bottom foot of the stems of plants of all ages in infested areas. It dries out to a thin crust which is claimed to remain effective for longer than two months, even in wet weather.

Eggs of snails and slugs should, as far as possible, be collected and destroyed by immersing them in approximately 50% salt solution. The eggs are usually deposited in damp places in the clearing, where rotting logs provide a suitable medium. Dead leaves should be raked away from the plants.

B.—INSECT PESTS.

Termites:

Termites are insects belonging to the Order Isoptera.

One species of termites may cause considerable damage in new plantings where the jungle has been felled and the land planted with the minimum of clearing.

Newly planted budded or seedling stumps are particularly liable to attack. Usually, trees suffering from root diseases are more readily attacked than healthy ones. Termites form underground tunnels and attack the roots of rubber trees they encounter. Once they gain entry, they advance towards the stem. Such trees may not show any external sign of injury and are invariably blown over by wind.

Mud trails are formed around the base, up to a height of two to three feet on some trees. Beneath this mud covering, termites eat the outer dead bark. Exposed inner tissues are liable to desiccation and are prone to attack of fungal diseases and borers.

Control: Satisfactory control may be obtained by the application of Dieldrin or Chlordane insecticides such as Dieldrex 15 (at a dilution of 1 in 300) and Intox 8 (at a dilution of 1 in 700).

The insecticide should be poured round the base of the attacked tree. The amount of solution required is about 1 to 2 pints per tree. Any mud trails on the trunk of the tree must be scraped down before the application of the insecticide.

Mites:

Mites are minute insects belonging to the Order Acarina. They do not cause serious injury to rubber except to those plants grown under unfavourable soil and weather condition.

The distortion of leaves and occasional leaf fall resulting in the complete defoliation of young shoots are due to the infestation of mites. They attack actively growing shoots and leaves. They puncture the epidermis of young leaves and suck the cell sap leaving minute scars visible to the naked eye.

Control: Effective control can be obtained by the application of ordinary sulphur dust or wettable sulphur spray. Four dusting rounds at weekly intervals, at the rate of eight pounds of sulphur per acre, are usually sufficient.

Scale Insects:

These are found on a few scattered young plants in nurseries and are not of much importance. They belong to the Order Coccidae.

Two common species of scale insects are *Coccus viridis* and *Saissetia nigra. Coccus viridis* is a flat green scale about 5 mm in length. *Saissetia nigra* is of the same length but is a convex purplish black insect.

The scales are found on green stems, leaf petioles and along the midribs and veins of leaflets. In severe infestation a large part of the stem is covered by them. They feed on the cell sap. Mass feeding weakens the plant resulting in leaf fall, death of the terminal bud and, sometimes, ultimate death of the plant.

Scale insects are often parasitized by fungi *Ceptralosporium lecanii* and *Hypocrella sp.* The former causes a white mould to grow over the scale and the later gives rise to hard spherical reddish orange globules. These fungi are beneficial in bringing about biological control of these insects.

Control: Chemical control methods are rarely necessary owing to the activity of the above-mentioned parasites. When chemical control measures are resorted to, the chemicals chosen must not be harmful to the natural enemies of these pests. An oil spray containing a suitable insecticide may be applied at weekly intervals until the pest is exterminated.

Mealy Bugs are Coccids which do not have a hard scale but have, instead, a white mealy secretion as a cover.

Control: An oil emulsion spray should give satisfactory control of these insects.

A pound of soap is dissolved in hot water and emulsified in a pint of kerosene. One part of this emulsion is diluted in 40 parts of water. The infested plant is thoroughly sprayed with this emulsion, the aim being to wet every mealy bug on the plant.

Cockchafer Grubs are larvae of the beetle *Leucopholis rorida.* These larvae are large, fleshy white and about three inches in length. They are generally found in the nurseries and can cause severe damage to young plants.

They eat off the tap roots of the young nursery plants nearly to the soil level and plants topple over and die. Similar fate can occur to field plants where the area is heavily infested with grubs.

Control: Application of Aldrin to the infested soil gives satisfactory control. The soil around the plant should be carefully loosened by forking and the insecticide is poured on to the soil at a concentration of 0.1% (*e.g.* 1 in 200 Aldrex 2). About 4 to 6 pints of the solution may be required for each plant.

Borers:

Tapping panels and diseased, dead or devitalized bark of rubber trees are attacked by borers belonging to the genus *Xyloborus.*

Perfectly round holes of the size of the cross section of the body of the insect, are bored on the bark.

Borers rarely attack healthy trees as the exuding latex forms a natural barrier.

Bark liable to borer attack may have been affected by diseases such as Bark rot, Canker, Pink disease or Root diseases, by die-back of branches or by fire, lightning or wind damage.

Control: Bark which has been severely attacked and penetrated must be removed. Exposed wood should be treated with a suitable waterproof fungicide, *e.g.* Kankerdood. Over this an application of a grease product may keep off the borers from further attack.

The primary cause which paved the way to the borer attack must first be investigated and attended to.

Dead wood lying around form good breeding grounds for these insects. Such material should be collected and burnt.

C.—GENERAL.

Any damage done by animals to branches or stems of trees should be attended to immediately. Broken branches should be neatly pruned off and the cut protected with a waterproof fungicide (as *e.g.* Kankerdood).

Any other wounds, caused by tearing or gnawing of the bark, should be cut clean and sealed off with a waterproof fungicide in order to protect them from fungal infection (as *e.g. Botryodiplodia theobromae*).

Nursery plants which are damaged should be lopped off and the cut end treated with a waterproof fungicide.

On no account should tar or tar-containing products or oily disinfectants be applied to wounds of young rubber trees, or on any growing tissues of young or old rubber plants, as such treatment could scorch and burn the plants and cause considerable additional damage. Under no circumstances, therefore, should tar products be painted onto the stems of rubber trees to protect them from attack by rats, porcupines, etc.

In general field sanitation is important. The maintenance of neat drains, clearing of stream banks, draining of swampy areas and general clearing up of those parts of the estate which are likely to harbour and breed bandicoots, rats and snails should be given full attention.

D.—WARNING.

Some of the chemicals used for pest control are poisonous to man and, if improperly handled, may cause fatal poisoning. For this reason and in order to obtain the highest degree of success, it is recommended that pest control work should, whenever possible, be always carried out by the same trained gang of labourers.

Furthermore, the instructions given by the suppliers of agrochemicals with their products, regarding the rate and method of application, safety and precautionary measures should be strictly followed.

PLANTING TOPICS

"Diagnostic Physiologique"

"Diagnostic Physiologique," ("DP" for short), is the method of physiological diagnosis developed and used in South Vietnam and Cambodia by French agronomists for determining the fertilizer requirements of Hevea plantings in those countries.

The problem of mineral nutrition of Hevea brasiliensis, as in other plants, has been the subject of investigation, both in the field and in the laboratory, in many countries over a long period of time.

There have been several avenues of approach.

1. Physical, chemical and microbiological analysis of the soil.
2. Fertilizer experiments in the field.
3. Study of mineral nutrition of plants grown on artificial media and the diagnosis of deficiencies by visual symptoms.
4. Foliar diagnosis.

While each of the above methods, or a combination of methods, has given useful information, there have always been drawbacks. For example, conclusions that can be drawn from fertilizer experiments in the field are applicable to the areas under investigation and extrapolation of the findings to apply to other areas do not always produce the desired results.

The most important criticism of foliar diagnosis has been that it makes no provision for the interdependence of the mineral elements in the foliage, for it is known that any variation in the proportion of one element can lead to a direct or an inverse correlation of one or several other elements, including micro-elements. Further, foliar diagnosis by itself gives no information on the way in which the elements absorbed from the soil are utilised in the plant.

Since 1951, the French workers at the "Institut des Recherches sur le Caoutchouc en Indochine" (I.R.C.I.), now the "Institut des Recherches sur le Caoutchouc au Vietnam" (I.R.C.V.), have studied the application of foliar diagnosis in Hevea with the object of discovering the laws which govern mineral metabolism. Their investigations have led them to believe that mineral diagnosis should be based on the degree of uptake and the degree of utilization of mineral elements. They have, therefore, developed a method called "Diagnostic Physiologique," which covers not only leaf analysis but also the analysis of corresponding latex, to obtain information on the mineral equilibria at the level of the leaves and of the tapping cut. The method derives its name from the fact that it is essentially based on physiological laws.

"DP" rests on the analysis of the elements N, P, K, S, Ca, Mg, Mn and Cu in the leaves and N, P, K, Mg and Cu in the latex. The rubber content of the latex samples is also determined. The results of the analyses of numerous samples have shown that, for growth in good physiological conditions, the ratios between the quantities of mineral elements are relatively constant, as are the absolute quantities,

Since the ratios or the products of the quantities of mineral elements are more expressive than the absolute quantities, the ratios or products are used in "DP" rather than absolute values. The different values which some of the ratios can have, according to the conditions of growth, have been established at the I.R.C.I. during the years 1951-1955 using numerous results obtained on varied plots, some planted on the Institute's experiment station and others on different commercial plantations in S. Vietnam and Cambodia on the typical red and grey soils. The validity of these ratios has been confirmed for all Heveas, whatever their age, genetic origin, method of tapping, soil and climatic conditions under which they are grown. These ratios have been found applicable also to young immature plantings.

It is claimed that there are several advantages in favour of this "DP" method which make it appear that it may be the most rational method for determining the fertilizer requirements of Hevea plants.

1. The method involves a comparative and complementary study of one part of the plant with another part of the same plant. This eliminates the most important criticism levelled against the method of foliar diagnosis, as the different parts sampled at the same time from the same plants are automatically exposed to the same common factors of variability, *e.g.* plant origin, age, season, ecological conditions, etc.

2. It enables a mineral unbalance in the plant to be rectified before the adverse effect on its physiological state is sufficiently advanced to cause leaf symptoms of malnutrition.

3. The method ensures the application of mineral elements that are necessary to bring about a correct mineral balance in the plant. It thereby avoids the application of mineral elements that are not lacking and which, if applied, will not only be wasteful but may even be detrimental.

   The relation between two antagonistic elements potassium and calcium is considered very important since variations in nitrogen, sulphur, phosphorus, iron and copper are linked to those of potassium and variations in magnesium, manganese and sodium are linked to those of calcium.

4. It is claimed that physiological diagnosis can follow, with time, changes in the productive capacity and in the physiological condition of the crop, with the possibility of constantly improving them.

The practical application of the method for fertilizer recommendations, in Hevea plantations in S. Vietnam and Cambodia, has given very favourable results over a wide area. Although the favourable responses in yield have been obtained mostly in areas not manured previously, it is reported that some of the areas that gave increases in yield had been previously manured with an NPK fertilizer mixture of empirical composition.

Of a total area of about 175,000 acres under Hevea in S. Vietnam the application of "DP," which covered an area of only 160 acres in 1954, has been gradually extended to cover an area of 100,000 acres in 1959.

For purposes of applying the "DP" technique Hevea plantings are divided into units, the size of a unit being determined by several factors. Some of the commercial plantations in S. Vietnam and Cambodia have found it worthwhile to establish

their own organizations to carry out the analytical work for purposes of determining the fertilizer requirements of the different areas in their plantations. There were five such laboratories functioning in 1959 in those two countries.

It is intended to try out this technique on an experimental scale in different parts of the rubber growing areas of Ceylon.

Estate Superintendents who wish to collaborate with the Institute in determining the suitability of the method for their conditions are requested to communicate with the Director. Those who agree to bring some of their areas under the control of "DP" should also give an assurance that fertilizer applications will be carried out according to the recommendations of the Institute.

It should be emphasized that the "DP" technique will be tried out on an experimental scale in 1960 and that parts of the experimental areas used as controls will continue to be manured as at present.

A. J. J.

QUESTION CORNER

Question:

The incidence of White Root Disease in my 3 to 4-year old replantings is high. I intend to control the disease with Tillex, as described in your Advisory Circular No. 62. Could you please let me know the rate of success which may be expected with this fungicide, compared with that obtained with copper sulphate?

Answer:

In extensive experiments carried out at this Institute with a wide range of fungicides we have found Tillex, an organo-mercury fungicide, to have the strongest fungicidal action on Fomes lignosus, the causal agent of White Root disease of Hevea. Field experiments and routine treatment on commercial estates have fully confirmed the excellent results obtained in the laboratory.

Tillex has now been in commercial use for 2 to 3 years and reports received from estates have shown its clear superiority over copper sulphate for the control of the White Root disease.

We give below one example taken at random:—

	Copper Sulphate treatment	Tillex treatment
No. of trees treated	998 ...	572
No. of trees which died subsequent to treatment	951 ...	89
No. of trees saved	17 ...	483
Rate of success	1.7% ...	84.7%

It should be pointed out that there has been no change in the mode of treatment of the White Root disease, the only difference is that copper sulphate has been replaced by Tillex, a stronger and more effective fungicide for the control of Fomes lignosus.

For the best results it is important that trees infected with Fomes lignosus are treated *as early as possible.*

Treatment with Tillex at the first signs of root infection, as shown by the typical yellowing of the foliage, has resulted in an average of 80 per cent of cures on several estates.

The earlier the diseased trees are detected and treated, the higher will be the rate of success obtained.

The method of treatment is described in detail in our Advisory Circular No. 62.

A.R.

Question:

My estate has experienced a heavy attack of Black Stripe disease and I am now faced with the problem of treating big patches of canker on the tapping panel. Please advise me of the best way of treating these canker patches.

Answer:

Black Stripe disease, or Bark Rot, is caused by the fungus Phytophthora palmivora. The disease usually starts from an infection on the renewing bark of the tapping panel and, if untreated, spreads mostly upwards, along the typical black lines in the renewing bark, the cambium and the outer layers of the wood; the rate of spread depending on weather conditions. Lateral spread is much less pronounced. Environmental factors which favour a rapid development of the disease are a high humidity and a relatively low temperature. These conditions are normally present during the monsoon seasons.

The disease may also spread in the cambium under outwardly healthy bark from which latex later oozes out.

Prompt treatment of an infected tapping panel aims at the total suppression of the infection. When, however, infection has become deep seated the control of its further spread becomes increasingly difficult, as the fungus cannot then be reached by any known fungicide. All the fungicides which are at present recommended for commercial use are only effective superficially and they do not reach the mycelium of a fungus which is protected by several cell layers of living tissues, whether bark, cambium or wood tissues.

Unfortunately no systemic fungicides, *i.e.* fungicides which are taken up by the plant and act on a pathogen present inside the plant, have been developed to date.

Antimucin and Kankerdood have only a superficial activity, they may penetrate to some extent through dead tissues (as may be caused by Phytophthora) but not through living tissues.

Black Stripe and Canker can be controlled only by exposing and treating the diseased tissues with an effective fungicide.

A similar disease, known as the collar canker of apple trees, caused by the fungus Phytophthora cactorum, a fungus closely related to the Black Stripe fungus Phytophthora palmivora, presents similar problems of control.

The control of this collar canker also becomes increasingly difficult as the disease becomes more deep seated. It is then necessary to cut out all diseased tissues and it is even recommended to cut well into *healthy* tissue to ensure the removal of all traces of mycelium and thus the eradication of the disease.

According to our own observations and information available in the literature on similar diseases we advise the following treatment for Bark Rot:—

1. All diseased bark tissue to be removed irrespective of size of the wounds caused, if further spread of the disease is to be controlled. The edges of the wounds should be *cut well into healthy tissue* with a clean, sloping cut.

2. The *superficial* layers of infected wood to be scraped off as much as possible, but, in order to avoid deep excisions which would be costly and which would weaken the trees, it is not practicable to follow up all black discolourations or lines deep into the wood. This procedure cannot, however, completely rule out the remote possibility that, under a certain combination of weather conditions favourable to the fungus, the disease may break out again.

3. The exposed wound (wood and bark) to be treated with Antimucin at a dilution of 1 : 120 and, when dry, to be painted over with Kankerdood. The dressing of Kankerdood to be renewed every six months until the wound has healed over completely.

4. Necessary steps to be taken to prevent, in future, the development of canker and, with that object in view, new cases of Black Stripe should be treated *as early as possible* after they have been noticed and reported.

A. R.

BOOK REVIEW

Elsevier's Rubber Dictionary

This dictionary in ten languages has been compiled by the Rubber-Stichting of Delft, Netherlands. It was published in 1959 by Elsevier Publishing Company, Amsterdam, and is distributed in the British Commonwealth by D. Van Nostrand Company Ltd., 358, Kensington High Street, London, W.14.

The revolutionary progress of natural and technical science and the flood of technical publications in different languages make it well nigh impossible for interested readers to maintain an up-to-date terminology of their particular subject in the more important languages. The difficulty of translating or of understanding scientific papers in a foreign language, even for those who speak it fluently and also read it, lies mainly in the technical terms employed. These rarely appear in the general vocabulary and have often been coined for some special purpose or have obtained a particular meaning different from their original one.

This led to a growing tendency of extending the usual specialized dictionaries to multilingual ones, in order to meet the demand for facilitating all types of translation work.

There has, for a long time, been an urgent need for a comprehensive rubber dictionary. The Rubber-Stichting initiated this work and through several years has been engaged on the elaborate task of compiling it, assisted by the Rubber Institutes and Organizations in the U.K., U.S.A., France, Germany, Sweden, Japan, Indonesia and by some commercial Companies in Holland and Italy.

When the Rubber-Stichting ceased its activities on the withdrawal of financial support from Indonesia, the Central Rubber Fund in Djakarta, Java, made the present edition possible.

This dictionary is the most comprehensive one yet compiled for the Rubber Industry and it is filling a long existing gap. The greater number of nearly 8,000 terms entered concerns the rubber manufacturing aspect, while the rest includes most of the terms used in rubber production.

The principles recommended by UNESCO have been used as a basis for planning this dictionary, which is arranged in such a system that equivalent words in the ten languages appear horizontally in the same line; the English version being the first, followed by the French, Spanish, Italian, Portuguese, German, Dutch, Swedish, Indonesian and Japanese (in Roman script) terms. For each of the nine languages there is a separate alphabetically arranged section with a numbered reference to the basic English sequence, thus making reference easy and systematic. The quality of the binding, printing and of the paper are excellent and the book is in a very handy size.

This dictionary has, very soon after its publication, proved to be a reference book of major importance at the Rubber Research Institute of Ceylon and, notwithstanding the rather high price of 315 shillings, may be highly recommended to all interested in the literature on rubber.

K. F. H.

MINUTES OF THE 164th AND 165th MEETINGS OF THE RUBBER RESEARCH BOARD

Minutes of the 164th meeting of the Rubber Research Board held at 10 a.m., on Monday, 19th October, 1959, in the Board Room of the Rubber Control Department.

Present:—Mr. S. Pathmanathan, in the Chair; Mr. W. P. H. Dias, J.P.; Mr. L. C. de Mel; Senator E. W. Kannangara; Mr. V. T. G. Karunaratne, M.P.; Mr. C. R. Warren; Dr. E. D. C. Baptiste, Director; Mr. C. D. de Fonseka, Chief Administrative Officer.

An apology for absence was received from Mr. H. Creighton.

Monsieur P. Compagnon, Director of Research of the Rubber Research Institutes of Vietnam and Cambodia, on a visit to Ceylon *en route* to Indo-China, was present by invitation.

The Chairman extended a cordial welcome to Monsieur Compagnon and invited him to give the Board members a talk on some aspects of rubber research. Monsieur Compagnon, after thanking the Chairman and Members of the Board, gave a $2\frac{1}{2}$ hour talk on his first impressions of Ceylon rubber, which he had seen during his tour round the rubber districts of Ceylon with the Director.

He described the technique of "Diagnostic Physiologique" as used in Indo-China for the manuring of rubber on commercial estates, and undertook to provide the necessary facilities for Mr. A. J. Jeevaratnam, Acting Soils Chemist, to study this technique, as well as the chemical methods which have been found to be the most satisfactory for leaf and latex analysis, during his forthcoming visit to Vietnam and Cambodia.

The yields and general performance of local and imported clones were mentioned in relation to the soil and climatic conditions prevailing in Vietnam and Cambodia, particular reference being made to the I.R.C.I. clones which have been introduced into Ceylon.

On the conclusion of his talk Monsieur Compagnon replied to a number of questions from Members on various aspects of rubber planting and research. The meeting then terminated with a vote of thanks to Monsieur Compagnon proposed by the Chairman.

RUBBER RESEARCH INSTITUTE OF CEYLON

Minutes of the 165th meeting of the Rubber Research Board held at 10 a.m., on Saturday, 7th November, 1959, in the Board Room of the Rubber Control Department, Eastern Bank Building, Fort, Colombo.

Present:—Mr. S. Pathmanathan (in the Chair); Mr. H. Creighton; Mr. L. C. de Mel; Mr. W. P. H. Dias, J.P.; Mr. E. W. Kannangara; Mr. V. T. G. Karunaratne, M.P.; Mr. B. Mahadeva (Rubber Controller); Mr. H. E. Peries (Deputy

Secretary to the Treasury); Mr. C. R. Warren, Dr. E. D. C. Baptiste (Director) and Mr. C. D. de Fonseka (Chief Administrative Officer).

An apology for absence was received from Dr. M. F. Chandraratne (Director of Agriculture) who is away from the Island.

The Chairman congratulated Mr. V. T. G. Karunaratne, on behalf of the Board, on his recent appointment as Parliamentary Secretary to the Minister of Local Government and Cultural Affairs.

1. **Minutes:**

(*a*) *Confirmation.*—Draft minutes of the meetings held on 24th July and 19th October, 1959, which had been circulated to members, were signed by the Chairman.

(*b*) *Matters arising from minutes:*

1. Research Assistants.—The recommendations made by the Selection Committee at its meetings held on 2nd September and 12th October, 1959, were approved and the following appointments were made:—

   Miss V. Sivapalan, M.Sc. (Madras)—Research Assistant, Plant Pathology Department.
   Miss R. Abdul Cader, B.Sc. (Ceylon)—Research Assistant, Soils Department.
   Mr. R. Satchuthananthavale, M.A. (Madras)—Research Assistant, Botany Department.

2. Assistant Plant Pathologist.—It was reported that Mr. O. S. Peries, Assistant Plant Pathologist, had left for the U.K. on 17th September, 1959, on a scholarship under the Technical Co-operation Scheme of the Colombo Plan, to follow a postgraduate course of training at the University of Bristol.

3. Special Committee consisting of the Chairmen and Directors of the Tea, Rubber and Coconut Research Institutes.—The recommendations made by the Committee at its meeting held on 11-7-59 were approved.

2. **Administrative Committee.**—The recommendations made by the Committee at its meetings held on 10-8-59 and 8-10-59 were approved and the following decisions were arrived at on the basis of these recommendations:—

(*a*) *Electricity Supply.*—The acceptance of A.C. current from the Government supply, on the terms agreed on, was approved.

(*b*) *Director's Report for the 1st Half Year,* 1959—was approved.

(*b*) *Research Programme for* 1960—was approved:

Plant Pathology Department.—Due to the increase of Phytophthora leaf disease, the intensification of research on this problem was approved.

Soils Department.—The adoption of the technique of "diagnostic physiologique," as used in Indo-China for leaf and latex analysis in connexion with the manuring of rubber, was approved.

(*d*) *Draft Estimates for* 1960.—The estimates of income and expenditure for 1960, as revised in accordance with the recommendations of the Administrative Committee, were approved subject to the addition of further financial provision to cover the cost of additional staff and equipment for the Pathology and Soils Departments.

The approved estimates provide for income and expenditure as follows:—

Estimated Income for 1960 ...		...	Rs. 2,226,144
Estimated Expenditure for 1960:			
Recurrent ...	...	Rs. 2,388,426	
Capital ...	...	,, 744,357	
			Rs. 3,132,783

In view of the unsatisfactory financial position of the Institute it was decided that the Hon'ble Minister of Agriculture and Lands be approached for a loan of one million rupees to meet future capital expenditure. A request should also be made for the research cess to be increased to Re. 1/- per 100 lbs. in order that the additional funds required for financing the increased research on phytophthora and manurial work may be available.

(*e*) *Experimental Committee.*—The recommendation that the Administrative Committee be replaced by an Experimental Committee to deal with experimental and estate matters was approved, and the following members were elected to serve on the Experimental Committee:—

1. The Chairman.
2. The Director, R.R.I.C.
3. The Director of Agriculture.
4. Mr. C. R. Warren.
5. Mr. H. Creighton.

(*f*) *Estate Superintendent's Reports—April to August,* 1959—were approved.

(*g*) *Estate Accounts, March to June,* 1959—were approved.

(*h*) *Symposium for Research on Natural Rubber at R.R.I. Malaya.*—It was agreed that the Institute be represented at this Symposium in August-September, 1960, by the Director and the Plant Pathologist.

(*i*) *V.A.'s Retirement.*—In view of the retirement of Mr. C. A. C. Bowen it was agreed that Mr. H. Creighton should serve as Visiting Agent.

(*j*) *Visit of Mr. P. Compagnon.*—The visit of Mr. P. Compagnon, Research Director of the Rubber Research Institutes of Vietnam and Cambodia to the Institute on 8th October was reported.

3. **Salaries Committee.**—The recommendations made by the Committee at its meeting held on 12th October, 1959, were approved.

4. **Building Committee.**—The recommendations made by the Committee at its meeting held on 12th October, 1959, were approved and contracts for the construction of the following buildings were awarded:—

(*a*) Soils Laboratory at Dartonfield.
(*b*) Addition to Field Laboratory and extension to Office at Nivitigalakele.

5. **Reports and Accounts:**

(*a*) *Report on Sulphur Dusting of Smallholdings*, 1958-59—was approved.

(*b*) *Receipts and Payments Account for the 2nd Quarter*, 1959—was approved.

(*c*) *Inventory Report for* 1958—was approved and sanction was given for the disposal of rejected and unwanted articles, as recommended in the report.

6. **Staff:**

(*a*) *Chief Administrative Officer.*—The resumption of duties by Mr. C. D. de Fonseka, Chief Administrative Officer, on 1st October, 1959, on the termination of his end-of-contract leave was reported.

(*b*) *Librarian.*—The resignation of Miss I. S. Wanigasekera, Librarian, on 30th September was reported and the recommendations of the Selection Committee for filling this post were accepted.

(*c*) *Assistant and Minor Staff.*—Changes in staff since the last meeting were reported and approved.

7. **London Advisory Committee.**—Minutes of the 13th meeting of the Agricultural Sub-Committee held on 20-5-1959 were tabled.

8. **General Matters:**

(*a*) *Death of the Hon'ble Mr. S. W. R. D. Bandaranaike.*—The Chairman reported that the laboratories and offices were closed on 28th September and 1st October, 1959, as a mark of respect to the late Mr. S. W. R. D. Bandaranaike.

(*b*) *Publications.*—The following publications were tabled:—

Annual Report for 1958.
2nd Quarterly Journal (June, 1959).

(*c*) *Next Meeting.*—It was decided that the next meeting of the Board be held on Friday, 15th January, 1960, at 10 a.m.

9. **Any other business:**

(*a*) *Despatch of budwood to I.R.C.V.*—In connexion with the request made by Monsieur Compagnon during his recent visit to Ceylon, it was agreed that budwood of 20 IAN clones be sent to the "Institut Des Recherches sur le Caoutchouc au Vietnam."

Printed for the RUBBER RESEARCH INSTITUTE OF CEYLON. *Dartonfield, Agalawatta, by* H. W. CAVE & CO. LTD., *Fort, Colombo.*

For the REST of your life...

ARPICO

LATEX FOAM

RUBBER MATTRESSES

- WASHABLE
- DURABLE
- CHEAPER
- HEALTHIER

No other type of Mattress can give you such comfortable restful sleep as one of Latex Foam.

It means easier bed-making, too.

You owe it to yourself to have this sheer luxury in your home.

Moulded in full size 6'.3" x 3' x 4" thick, complete with strong cloth cover for only Rs. 150/-

MADE OF PURE CEYLON RUBBER BY:

RICHARD PIERIS & CO., LTD.

HYDE PARK CORNER, COLOMBO TELEPHONE. 6277

RP 910

'PERENOX'

'PERECLOUD'

For efficient control of PHYTOPHTHORA on Rubber

Contact

Imperial Chemical Industries (Export) Ltd,

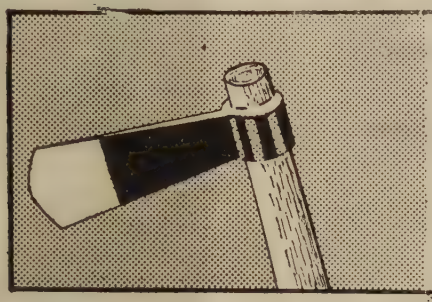
P. O. Box 352

COLOMBO.

BIPED

Tools that stand up to it

Biped tools are made in England by A. & F. Parkes & Co. Ltd., from the finest steel and are available in patterns to suit Ceylon's specific requirements. We stock the entire range of Biped brand estate tools, alavangoes, felling axes, mamoties and mamoty orks.

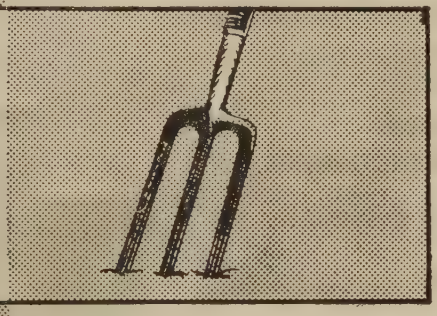


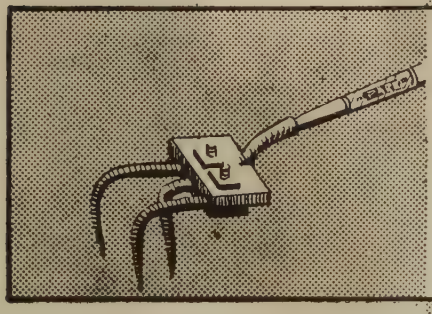
FELLING AXE

Felling time is considerably reduced because the blade rarely needs honing.

DIGGING FORKS

Bayonet Prong 3 x 18″ or Square Prong 4 x 18″ really strong and reliable.





3-PRONG DRAG CULTIVATOR

Recommended to take the place of short-tined forks for light cultivation.

MAMOTIES

Very effective, low-priced and fully guaranteed. Made to the right weight to suit local requirements.

THE COLOMBO COMMERCIAL COMPANY LIMITED

(Incorporated in Great Britain. Liability of Members is Limited.)

General's Lake Road, Colombo 2 — Telephone: 79351

MISTRAL II AB

SULPHUR DUSTING MACHINE

NEW — increased power, reduced weight.

LIGHT — 88 lbs. (without handles)—amazingly portable.

POWERFUL — 4 stroke BASCO engine developing 2.75 H.P.

STURDY — solid rigid cast construction cuts down vibration.

TROUBLE FREE — deals efficiently with lumpy sulphur.

OPTIONAL EXTRAS:

LIGHTING UNIT
TROLLEY

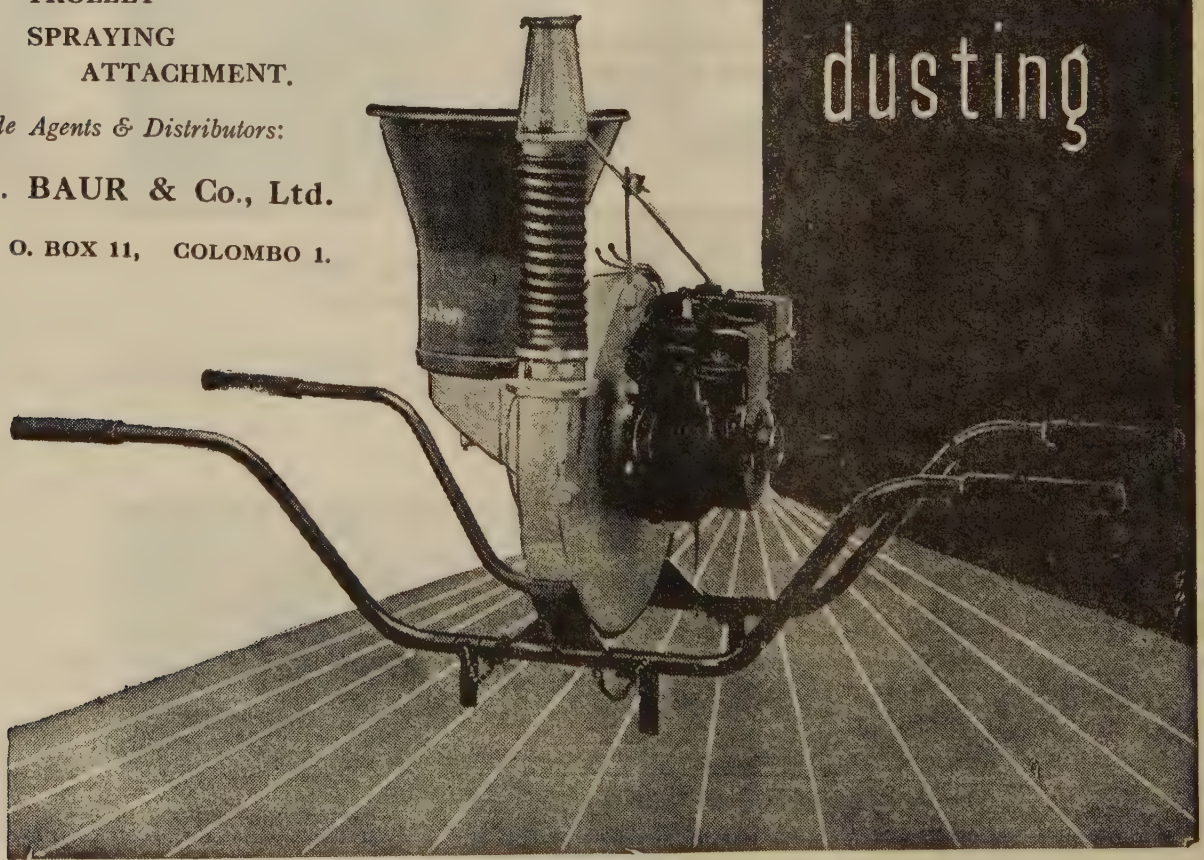
SPRAYING
ATTACHMENT.

Sole Agents & Distributors:

A. BAUR & Co., Ltd.

P. O. BOX 11, COLOMBO 1.

designed for efficient and economical dusting



WEIGHT 88 Lbs. (without handles)

RUBEROID
ROOFING

for maximum protection at minimum cost per year of service.

The reputation of RUBEROID ROOFING is based on over sixty years of continuous service in every climate. It represents the highest quality of bituminous roofing and is regularly specified for all types of buildings to give lasting protection with the minimum of upkeep costs.

Supplied in three weights from 1-ply to 3-ply. In rolls of 24 square yards 36 inches wide. Each roll covers approximately 200 square feet of roof surface.

- **HEAT RESISTING**
- **VERMIN PROOF**
- **ODOURLESS**

REELIA ROOFING

A high grade Roofing Felt of lighter quality than 'RUBEROID' also manufactured by the Ruberoid Co., Ltd. In Rolls 72' × 3' × 1, 2 and 3-ply.

LEAKSEAL ROOFING COMPOUND

A ready-to-use waterproof compound for quickly repairing cracks in leaky concrete, for use around bolt-heads and laps of corrugated iron and for stopping leaks in gutters, slates and tiled roofs.

Black or Red, in a range of container sizes.

COMPLETE LISTS AND SAMPLES SENT ON APPLICATION

SOLE AGENTS

The Ironmongers and Estate Suppliers of Ceylon

HUNTERS

HUNTER & COMPANY LTD.

P. O. Box 214

Telephone : **5297-9**

SECONDARY LEAF FALL and DIE BACK

are caused by

PHYTOPHTHORA

Which can be easily controlled with

BLENDOX 4% Cu. DUST.

A Product of

FISONS (CEYLON) LTD.

Which is available from

HARRISONS & CROSFIELD LTD.

MACKWOODS LTD.

and

SHAW WALLACE & HEDGES LTD.

WHEN PHYTOPHTHORA ATTACKS
YOUR RUBBER TREES

USE

CANDARSAN

"Ph"

This dressing has been specially prepared as a preventive dressing against **bark rot.**

It contains no copper or coal tar.

MADE BY THE MANUFACTURERS OF

CANDARSAN

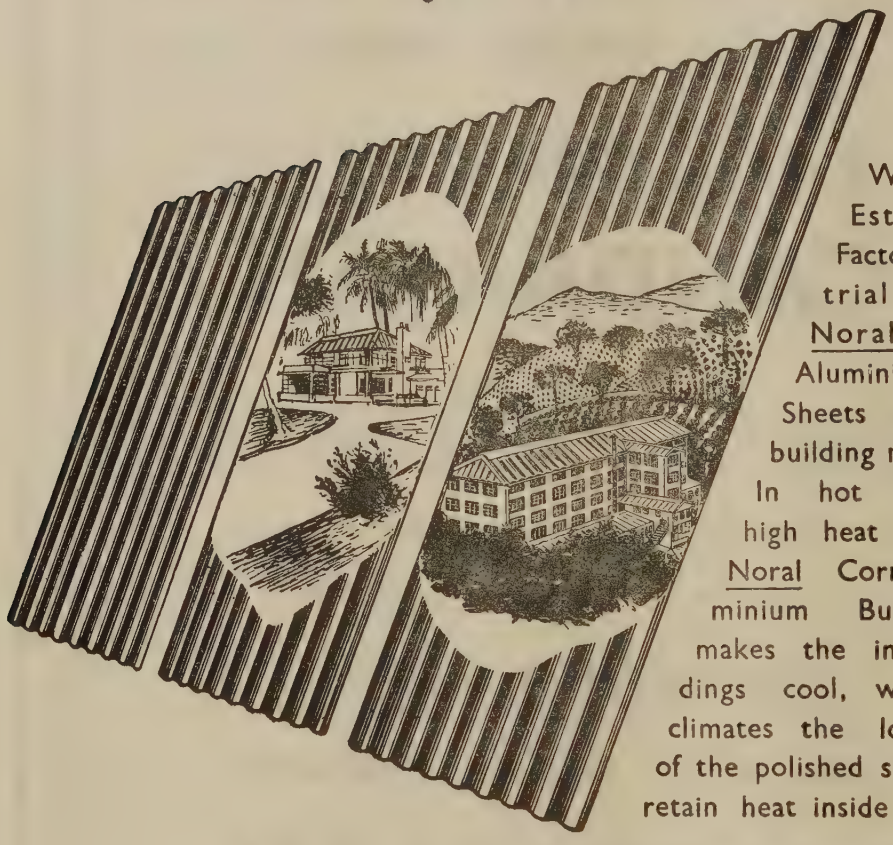
Obtainable from

BROWNS GROUP BG ESTABLISHED 1875

BROWN & CO. LTD.

COLOMBO · NAWALAPITIYA · HATTON

NORAL *Corrugated Aluminium Building Sheets top them all*



Whether it is for Estates, Homes, Factories or Industrial Buildings, Noral Corrugated Aluminium Building Sheets are the ideal building material.

In hot climates, the high heat reflectivity of Noral Corrugated Aluminium Building Sheets makes the inside of buildings cool, while in cold climates the low emissivity of the polished sheets helps to retain heat inside the buildings.

Noral Aluminium Sheet is light in weight, durable, and highly resistant to weather and humid tropical atmosphere.

MACKWOODS LIMITED

POST BOX 91, COLOMBO.

AUX 14

NORAL Aluminium Building Sheets are available in semi-circular and other special profiles in various widths, lengths and thicknesses, particulars of which may be had on request.

The following sizes of **NORAL** semi-circular corrugated sheets are normally stocked in Colombo:—

26″ width by 24 SWG thickness in lengths 6′, 7′, 8′, 9′, 10′ & 12′

32″ width by 24 SWG thickness in lengths 6′, 7′, 8′, 9′, 10′ & 12′.

Finest on Earth

THE COLOMBO COMMERCIAL CO., LTD.

(Incorporated in Great Britain. Liability of Members is Limited)
P. O. Box 33, Colombo

CCC 630

THE PATENT

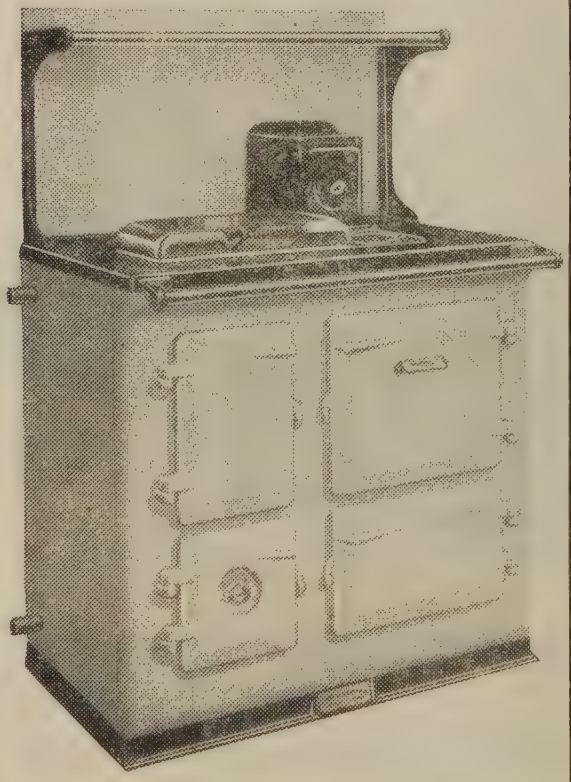
WELLSTOOD

INSULATED COOKER

CONTINUOUS - BURNING & ECONOMICAL

For immediate delivery

Gives instant cooking service and constant hot water for baths and washing-up.



FINISHED IN CREAM, BLACK & CHROMIUM

EFFICIENT · ELEGANT · EVER READY

Full Particulars and Prices on Request.

The WELLSTOOD is a new production by the makers of the world-famous ESSE Heat Storage Cookers. It is an insulated cooker, designed to burn any type of solid fuel with conspicuous economy and great cooking efficiency, although it is not a Heat Storage Cooker

Suitable fuel in Ceylon is Coke, Coal or Coconut Shell Charcoal. Firewood can also be used but is not suitable for overnight burning.

It keeps alight overnight on a minimum fuel consumption thus saving the daily labour of cleaning out and re-lighting the fire. Constructed on the most modern lines and to the highest Government Standards the WELLSTOOD embodies patented features included in oven heating providing continuous hot water supply and draught control.

Cooking Facilities: These are generous for so compact a cooker. The fast-boiling hot-plate measures 172 square inches and for two-thirds of this area the boiling rate is extra-fast with machined base utensils. Simmering space is available also and there is useful warmth on the outer top-plate.

The two ovens have ample capacity and balanced temperatures the upper (fitted with heat indicator) is excellent for roasting and baking, and the lower for slow cooking and plate warming.

SOLE AGENTS FOR CEYLON

The Ironmongers and Estate Suppliers of Ceylon

HUNTERS

HUNTER & COMPANY, LIMITED

P. O. Box 214

Telephone: **5297-9**

Planters Will Keep Country Ahead !!!

FULL PRODUCTION—HIGHER WAGES—GREATER CONSUMPTION—BETTER PRICES

And support higher living standards and increased internal consumption markets

Grow **CLOVERS—GREEN MANURE COVER CROPS—BUSH COVERS GROUND COVERS—TREE COVERS**

Most effective Natural Manures—They give your Money better Results

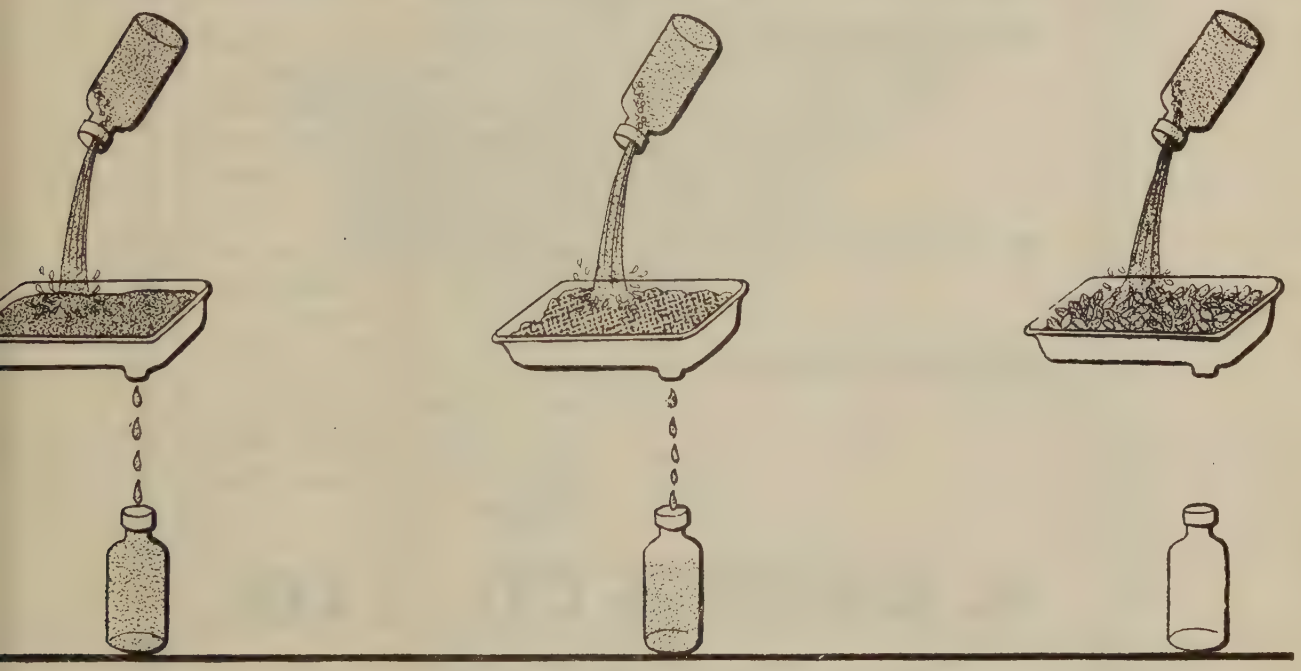
Help *SOIL CONSERVATION* Retain *SOIL MOISTURE*

Add humus or vegetable matter to the soil, which increase capacity to retain rain water on lands. Prevent surface soil wash and erosion. Suppress weeds, thus, saving on labour. Leguminous plants fix atmospheric nitrogen in soil. Ensure continuity of full production with the increased fertility by the conservation of top soils under cover crops. Organic matter and leaf mould deposits help retain rain water on lands.

Now considered an advance in agriculture and is a requirement under Government Subsidised Schemes that Tea, Rubber, Cocoa and Coconut Replantings of uneconomic fields should be perfectly covered with leguminous green manure cover crops before final payments are made.

To obtain best results, mix two parts of seed with one part of Saphos Phosphates and one part of dry earth or sand and sow in beds 4ft. by 4ft. and 6ft. apart between the rows of your plantation in the case of Creeper Ground Covers and sow in drills between the rows of your plantation and in ridges and contour bunds in the case of Bush Cover Crops. Tree Covers are established for shade, as Windbelts and for Timber and Fuel Purposes.

GOVERNMENT NOW CONTEMPLATES ENFORCING LEGISLATION ON SOIL CONSERVATION!!



If a bottle of water is poured into a tray filled with sand, the water is completely drained out. The same quantity of water is poured into a tray filled with earth, only a fraction of the water is retained and the major portion of the water is drained out. See the same quantity of water poured into a tray filled with leaf mould and organic matter, the water is sucked in completely and practically all the water is retained in the tray. Thus, in sandy soils, all rain water is drained out and on other soils, only a part is retained on the land, but, where Leguminous Green Manure Cover Crops are established, all the rain water is retained on your land due to organic matter, dry leaf mould and green mulching.

As recommended by U.S.A. Agriculturists and now accepted and approved as an advance in Agriculture by the Food & Agricultural Organisation of the U.N.O. advocating free exports.

SOW FRESH SEEDS. AVAILABLE FROM US. Write for List to

H. D. CONSTANTINE & SONS

P. O. Box 378, COLOMBO, CEYLON.

FUNGICIDES FOR RUBBER

● **ANTIMUCIN WBR** — water miscible liquid fungicide based on mercury for routine application to tapping panels for the control of **bark rot (black stripe) and canker diseases.**

● **ANTIMUCIN W B (colourless)**
for the prevention of **mould and rust in smoked sheet and crepe.**

● **KANKERDOOD** — non-greasy highly adhesive waterproof fungicide for the **protective treatment of tapping panels and rapid healing of canker wounds.**

● **TILLEX LIQUID** — mercurial fungicide for the control of the **Fomes or white root disease.**

● **COPPER-SANDOZ 4% DUST** —
high quality copper fungicidal dust for the control of the **phytophthora leaf disease.**

A. BAUR & CO., LTD.,

Specialist Suppliers of

FERTILISERS,

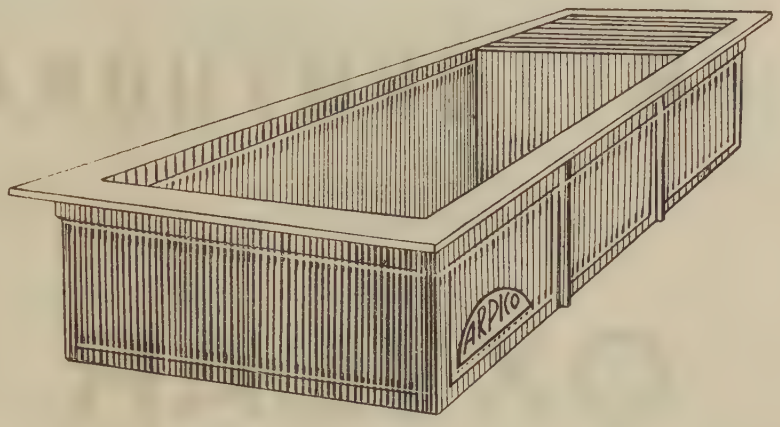
INSECTICIDES, FUNGICIDES,

SPRAYING & DUSTING EQUIPMENT

P. O. Box 11, COLOMBO.

ARPICO

ALUMINIUM LATEX COAGULATING TANKS



These Aluminium Latex Coagulating Tanks, fabricated from Aluminium Alloy Sheets and Sections and Argon Arc Welded, are sturdily constructed to ensure years of trouble - free service.

- CLEAN UNIFORM SHEETS.
- LABOUR SAVING.
- SIMPLE TO OPERATE.
- EASY TO HANDLE.

AVAILABLE IN 10′ × 3′ × 1½′ — 240 GALLONS CAPACITY.

In Types SCT/S/90 and SCT/P/90 with loose 16 SWG Aluminium Partitions 1 3/16″ apart, and Types TCT/S/88 and TCT/P/88 with 2 fixed 10 swg. and 88 Loose 16 SWG. Partitions 1 13/16″ apart.

Write to us for full particulars and sizes:—

RICHARD PIERIS & CO., LTD.

Aluminium Agency Dept. Hyde Park Corner, Colombo, 2

PROTECT YOUR
VALUABLE CLONAL
RUBBER FROM

PHYTOPHTHORA

BY DUSTING WITH

OXYCAR

CARSON CUMBERBATCH & CO., LTD.
CHARTERED BANK BUILDING,
COLOMBO.
Telephone 79281.

RICHARDSONS' PAINTS.

HAVE YOU TRIED RICHARDSONS' ANTI-CORROSIVE PAINTS FOR YOUR FACTORY AND OTHER ESTATE BUILDINGS?

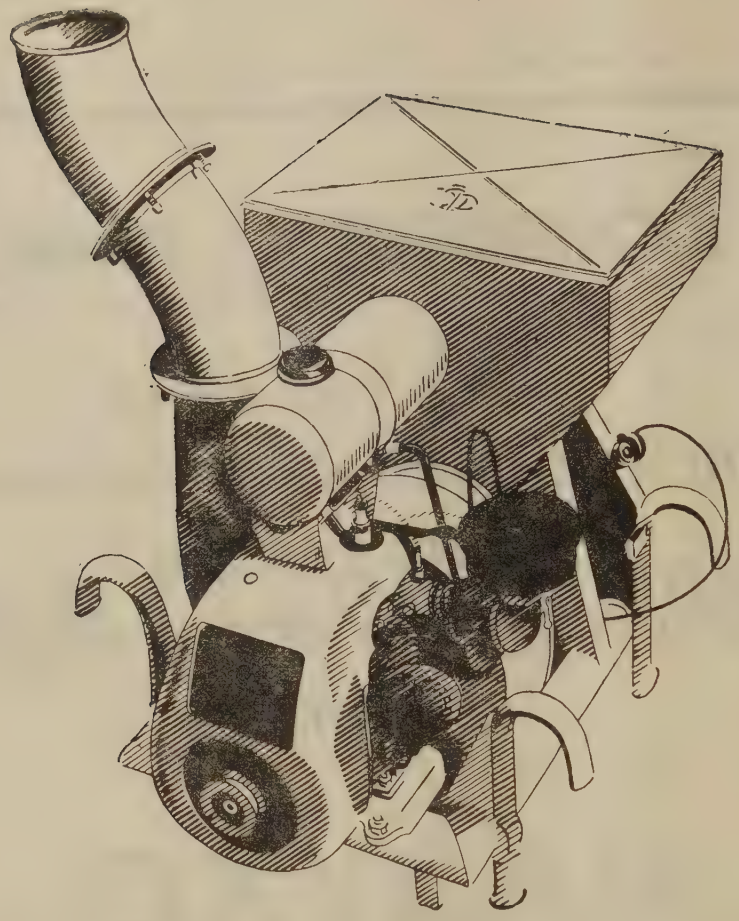
THEY ARE EXCELLENT VALUE AND OF FIRST CLASS QUALITY.

Aluminium	**Rs. 27/-**	per gallon less 5%.
Green	**Rs. 27/-**	,, ,, ,, 5%.
Red	**Rs. 26/-**	,, ,, ,, 5%.

Packed in 5 gallon drums.

Apply to :

C. A. C. BOWEN,
E. D. DE ALWIS,
Dalkeith Group,
Latpandura.



The C.C.C. 'NOIDIUM' Machine for Sulphur Dusting

The C.C.C. 'NOIDIUM' Sulphur Dusting Machine is designed to give the lightest possible machine coupled with high efficiency and moderate cost. It incorporates all the advantages of the heavier machines of the past with regard to velocity of blast—with none of the inherent disadvantages of excessive weight and difficulty in handling.

SPECIFICATION

ENGINE driven by Mark 12, 4-stroke, Villiers Petrol Engine

PETROL : Will run for at least 3 hours with full tank

WEIGHT : Unladen 79 lbs.—with carrying handles, full tank & hopper with 50 lbs. of Sulphur—weight 145 lbs.

FAN : When running at 3000 R.P.M. delivers Sulphur to the tops of highest trees under normal dusting conditions.

HOPPER : Capacity 50 lbs. which is sufficient for 18 minutes of dusting.

DISCHARGE DUCT is fitted with a double bend all directional duct which permits dusting at all angles.

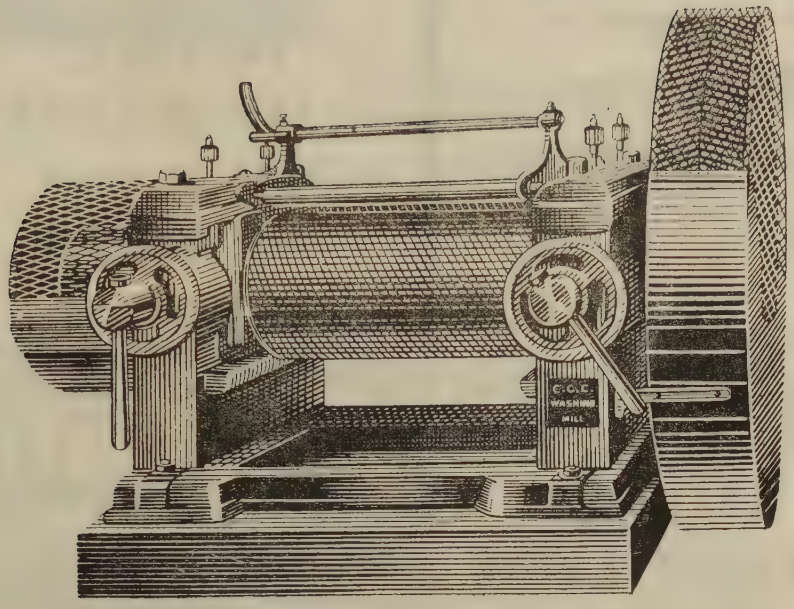
SULPHUR FEED is on suction side of the fan and the dust discharged is free of lumps.

MOBILITY : This light, well balanced machine can be carried by two men.

THE COLOMBO COMMERCIAL COMPANY LIMITED

(Incorporated in Great Britain. Liability of members is Limited.)

General's Lake Road, Slave Island, Colombo 2, Telephone : 79351.



CCC RUBBER WASHING MILLS

Low maintenance costs, permanently accurate alignment, and freedom from vibration during even the hardest rolls explain the permanent popularity of the CCC Rubber Washing Mill in Ceylon and Malaya. Over 250 of these machines are in daily use in these two largest rubber-producing countries of the world.

Their immense strength ensures years of hard use.

Proved thoroughly efficient for

Macerating. Washing. Creping. Sheeting. Blanketing Sole-creping.

Available in 2 roll-sizes: **22″ long by 12″ diameter**
26″ long by 14″ diameter

We supply any type of internally water-cooled rolls of imported close grain or chilled cast iron with smooth surface or grooved to any desired pattern.

Consult us for your special requirements:

THE COLOMBO COMMERCIAL CO., LTD.

(Incorporated in Great Britain. Liability of members is Limited)
General's Lake Road, Slave Island, Colombo. Telephone: 79351

For total weedkilling on Rubber plantations

SHELL WEEDKILLER P. 12

Specially formulated for use on rubber plantations, Shell Weedkiller P. 12 is a most effective total weedkiller. and mixing with Shell Weedkiller D (AMINE) or with AMINO-TRIAZOLE increases its effects.

SHELL

For further details write to :-

THE SHELL COMPANY OF CEYLON LIMITED,
P. O. Box No. 280.
Colombo.

SAFETY

IN YOUR

FACTORY,
LABOUR LINES

AND IN YOUR

BUNGALOW,

WITH

DIELDRIN

the new Public Health Insecticide.

Use Dieldrin 50% Wettable Powder for lines, latrines, animal sheds and porous wall surfaces. 2 ozs. of wettable powder in a gallon of water will be enough to treat 1000 square feet of wall surface.

SHELL

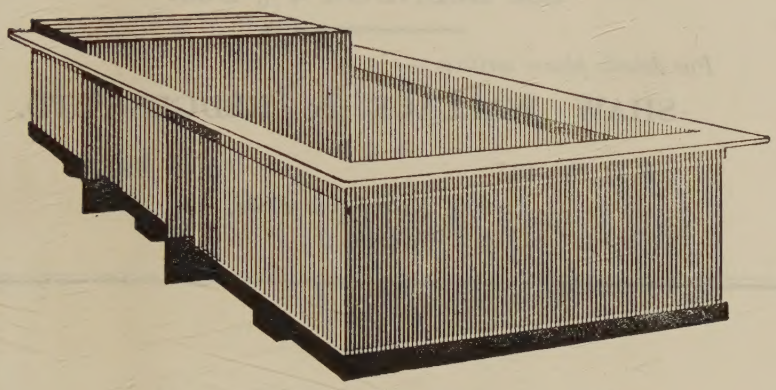
For further details write to :-

THE SHELL COMPANY OF CEYLON LIMITED,
P. O. Box 280,
Colombo.

SH/GC/47

DCL

ALL ALUMINIUM COAGULATING TANKS



DCL All-Aluminium Coagulating Tanks are constructed to ensure years of trouble-free service. The shell is formed of one plate of pure aluminium and the reinforcing frame is fabricated from aluminium alloy sections.

DCL Coagulating Tanks ensure.

* Clean uniform sheets
* Substantial saving in time and labour costs
* Saving in equipment, no replacements of pans and other receptacles.
* The minimum percentage of froth sheets
* Saving in factory space

Tanks can be made to your requirements.
The standard capacity range is from 155 to 245 gallons.

Write to us for full particulars and prices

THE COLOMBO COMMERCIAL CO., LTD.

(Incorporated in Great Britain. Liability of members is Limited)

General's Lake Road Colombo. Telephone: 79351

CCC 886

"STERAMEAL"

(*Sterilised Animal Meal Black Label*)

Ideal for

YOUNG RUBBER

Ensures early Tapping

For economic control of Phytophthora

Use BLENDOX 4% Dust

For details please write to:—

SHAW WALLACE & HEDGES LTD.

P. O. Box 137 *Tel.* **78271.**

363, *Kollupitiya Road,*
Colombo 3.

Advertisements are accepted on the understanding that the Institute accepts no responsibility for the claims made therein.